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10/736,951	12/15/2003	E. Frederic Herkenhoff	T-6313	5540

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EXAMINER

HUGHES, SCOTT A

ART UNIT PAPER NUMBER

3663

DATE MAILED: 05/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

10/736,951

**Applicant(s)**

HERKENHOFF ET AL.

**Examiner**

Scott A. Hughes

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12/15/2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____.  |

DETAILED ACTION

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-15 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Vaage.

With regard to claim 1, Vaage discloses a method for obtaining seismic data. Vaage discloses translating a constellation of seismic energy sources along a survey path (Fig.1), the seismic energy sources including a reference source SA1 and at least one satellite energy source SB1 (Column 4). Vaage discloses activating the reference energy source and the at least one satellite energy source at a time delay relative to the activation of the reference energy source once each at spaced apart activation locations along the survey path to generate a series of superposed wavefields which propagate through a subsurface and are reflected from and refracted through material heterogeneities in the subsurface, the time delay being varied between the spaced apart activation locations (Column 6, Lines 10-51). Vaage discloses recording seismic

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data including seismic traces generated by the series of superposed wavefields utilizing spaced apart receivers (Column 4; Column 5, Lines 31-65).

With regard to claim 2, Vaage discloses processing the seismic data using the time delays to separate signals generated from the respective energy sources (Column 6, Lines 45-52).

With regard to claim 3, Vaage discloses that a step of recording seismic data includes recording amplitudes of the superposed wavefields, the location of the receivers, the locations of the energy sources, and the time delays between the activations of the reference energy source and the satellite energy source (Column 4, Lines 33-60; Column 6).

With regard to claim 4, Vaage discloses processing the seismic data further including sorting into a common-geometry domain and replicating the seismic traces of data into multiple datasets associated with each particular energy source. Vaage discloses time adjusting each trace in each replicated dataset in the common-geometry domain using the time delays associated with each particular source to make signals generated from that particular energy source generally coherent while rendering signals from the other energy sources generally incoherent (Columns 8-10, especially Column 9, Line 54 to Column 10, Line 22).

With regard to claim 5, Vaage discloses that the common-geometry domain is common depth point or common-offset domain (Columns 10 and 11).

With regard to claim 6, Vaage discloses attenuating the incoherent signals from the datasets of coherent signal and incoherent signal associated with the respective

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energy sources to produce enhanced data sets associated with the respective energy sources (Columns 10 and 11).

With regard to claim 7, Vaage discloses that the attenuation step included using at least one of Radon filtering, stacking and migration (Column 9, Line 54 to Column 11, Line 65) and dynamic noise attenuation (Column 8).

With regard to claim 8, Vaage discloses that the step of attenuation included using dynamic noise attenuation wherein the relative amplitudes of the coherent signals from each of the respective energy sources are preserved (Column 8).

With regard to claim 9, Vaage discloses that the at least one satellite energy source includes a plurality of energy sources, and time delays are variable between each of the plurality of energy sources in the constellation at each of the activation locations (abstract; Column 3, Lines 15-35; Column 6; Column 9).

With regard to claim 10, Vaage discloses that the time delay includes a constant portion  $t_c$  which remains constant for any particular source for the duration of the seismic survey and a variable portion  $t_v$ , which varies for each source and for each activation location (Column 6, Lines 10-45). Vaage discloses that the constant time is the time of a wavelet, and that the timing is varied from this value so that each time delay is at least as long as the time of a wavelet.

With regard to claim 11, Vaage discloses that the constant portion  $t_c$  is different for each satellite source (Column 6).

With regard to claim 12, Vaage discloses that the receivers 2a-d are disposed generally in a linear alignment along a predetermined length (Fig. 1) (Column 4, Lines 40-46).

With regard to claim 13, Vaage discloses that an elongate streamer includes a cable and the receivers and the streamer is towed by a marine vessel (Fig. 1) (Column 4, Lines 32-50).

With regard to claim 14, Vaage discloses that the reference energy source and the at least one satellite energy source is generally collinear with the streamer (Fig. 1) (Column 3, Lines 60-65; Column 4, Line 60 to Column 5, Line 31). In column 3, Vaage discloses that the sources can be parallel to or along the survey line.

With regard to claim 15, Vaage discloses that at least one of the energy sources is located laterally outboard from the linear alignment of receivers a distance of at least one-tenth of the length of the receiver cable (Fig. 1) (Column 3, Lines 60-65; Column 4, Line 60 to Column 5, Line 31). Vaage discloses that the sources can be parallel to or along the survey line.

With regard to claim 20, Vaage discloses that the variable time delays range from plus to minus one-half the time interval between successive activation locations (Column 6).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 are rejected under 35 U.S.C. 102(b) as being anticipated by DeKok (US20020181328 A1).

With regard to claim 1, DeKok discloses a method for obtaining seismic data. DeKok discloses translating a constellation of seismic energy sources along a survey path (Figs. 1a, 4), the seismic energy sources including a reference source and at least one satellite energy source. DeKok discloses activating the reference energy source and the at least one satellite energy source at a time delay relative to the activation of the reference energy source once each at spaced apart activation locations along the survey path to generate a series of superposed wavefields which propagate through a subsurface and are reflected from and refracted through material heterogeneities in the subsurface, the time delay being varied between the spaced apart activation locations ([0011]-[0013]). DeKok discloses recording seismic data including seismic traces generated by the series of superposed wavefields utilizing spaced apart receivers 207 ([0026]).

With regard to claim 2, DeKok discloses processing the seismic data using the time delays to separate signals generated from the respective energy sources (column 4, Lines ([0024 2<sup>nd</sup> column]; [0027]).

With regard to claim 3, DeKok discloses that a step of recording seismic data includes recording amplitudes of the superposed wavefields, the location of the receivers, the locations of the energy sources, and the time delays between the activations of the reference energy source and the satellite energy source ([0026]-

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0031])). DeKok discloses measuring the amplitude, and states the towed streamers and sources located in certain positions as seen in the figures. Therefore, the positions of the streamers and the sources would be known.

With regard to claim 4, DeKok discloses processing the seismic data further including sorting into a common-geometry domain and replicating the seismic traces of data into multiple datasets associated with each particular energy source. DeKok discloses time adjusting each trace in each replicated dataset in the common-geometry domain using the time delays associated with each particular source to make signals generated from that particular energy source generally coherent while rendering signals from the other energy sources generally incoherent ([0027]-[0031]).

With regard to claim 5, DeKok discloses that the common-geometry domain is one of common-midpoint [0027]-[0029]

With regard to claim 6, DeKok discloses attenuating the incoherent signals from the datasets of coherent signal and incoherent signal associated with the respective energy sources to produce enhanced data sets associated with the respective energy sources [0027]-[0029].

With regard to claim 7, DeKok discloses that the attenuation step included using at least one of Radon filtering, FX filtering, dynamic noise attenuation, stacking and migration [0027]-[0031]. DeKok discloses FK filtering, migration, stacking, and dynamic noise attenuation.



With regard to claim 8, DeKok discloses that the step of attenuation included using dynamic noise attenuation wherein the relative amplitudes of the coherent signals from each of the respective energy sources are preserved [0038], [0008].

With regard to claim 12, DeKok discloses that the receivers are disposed generally in a linear alignment along a predetermined length 407 409 (Fig. 4).

With regard to claim 13, DeKok discloses that an elongate streamer includes a cable and the receivers and the streamer is towed by a marine vessel (Fig. 4) [[0031].

With regard to claim 14, DeKok discloses that the reference energy source 203,205 and the at least one satellite energy source 413, 415 is generally collinear with the streamer (Fig. 4).

With regard to claim 20, DeKok discloses that the variable time delays range from plus to minus one-half the time interval between successive activation locations [0024].

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaage or DeKok in view of Jacobsen.

With regard to claims 16 and 17, Vaage and DeKok disclose sources towed upstream and downstream from the seismic streamer (Vaage, Fig. 1, Columns 3-5) (DeKok, Fig. 4). Vaage and DeKok disclose that using spaced apart source arrays increases the effective subsurface coverage of the streamer of sensors (Vaage, Column 3 to Column 4), but do not give a distance of separation from the streamer to the sources. Jacobsen (abstract, all) discloses that the fold of a streamer is doubled by positioning a second source a distance of 1 streamer length from the streamer of receivers. It would have been obvious to modify Vaage and DeKok to position the second sources in front of or behind the streamer at a position that was one streamer length away in order to increase the fold of the streamer and obtain more information about a subsurface with the same steamer as disclosed by Jacobsen.

Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaage or DeKok in view of Howlid or Leaney (WO0210798).

With regard to claim 18, DeKok and Vaage do not disclose that the receivers are fixed relative to the earth. The both disclose streamers towed by boats. Howlid discloses that it is also known in the art to use fixed ocean bottom cables of receivers instead of towed streamers to take a marine seismic survey ([0003] – [0004]). Leaney also discloses using fixed ocean bottom receivers in marine seismic surveys instead of towed streamers (Fig. 1) (page 1). It would have been obvious to modify DeKok and Vaage to use fixed OBC cables that would have fixed receivers relative to the earth as taught by Howlid or Leaney in order to have receivers coupled to the formation that is

being imaged instead of receiving signals that travel back through the formation and a water column to the receivers.

With regard to claim 19, Vaage does not disclose that the receivers are in a well bore. DeKok discloses that the method of firing the sources and recording the data can be used on land and in the marine applications as described in his disclosure. He does specifically say that the method can be used with receivers in a well bore when discussing land applications. Leaney discloses places receivers in a cable in a well bore 11 in marine seismic surveys such as those conducted by Vaage and DeKok (Fig. 1) (Page 7). It would have been obvious to modify Vaage and DeKok to include receivers in a well bore as taught by Leaney in order to obtain a vertical seismic profile of the underground formation below the water in the area of a well bore.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over DeKok in view of Krebs.

With regard to claim 19, DeKok discloses that the method of firing the sources and recording the data can be used on land and in the marine applications as described in his disclosure. He does specifically say that the method can be used with receivers in a borehole when discussing land applications, but it is known in the art that placing receivers in a borehole with multiple sources on the surface is a method of taking a seismic survey in land applications (See Krebs 6002642). It would have been obvious to include receivers in a borehole to take the data in the land applications recited by DeKok in order to gain a survey of an underground formation.

***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Newman, who discloses operating sources with a time delay in a marine seismic survey.

Ward, who discloses processing superposed signals.

Douma, who discloses timed shooting of sources with a dynamic delay.

Zachariadis, who discloses multiple source data acquisition.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott A Hughes whose telephone number is 571-272-6983. The examiner can normally be reached on M-F 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Tarcza can be reached at (571) 272-6979. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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